

# *Coordinated Development of Urban Development and Natural Protection Environment Based on Machine Learning*

**Olcese Umberto\***

*Univ Salamanca, BISITE Res Grp, Edificio Multiusos I D I, Calle Espejo 2, Salamanca 37007, Spain*

*\*corresponding author*

**Keywords:** Coordinated Development, Environmental Protection, Urban Development, Machine Learning

**Abstract:** There is a certain conflict between urban development and natural protection. To coordinate the relationship between them and promote their common healthy development is one of the most important hot issues in the current research field. On the one hand, it is necessary to ensure that people and natural environmental systems can live in harmony; on the other hand, the damage caused to the natural environment by the economic and social construction process cannot be ignored. These two aspects not only depend on whether to meet the needs of contemporary human beings without endangering the living space of future generations, but also depend on various conflicts caused by the development and utilization of natural environmental resources and the production activities of urbanization. In order to solve the problems of the traditional natural environment protection model, such as the failure to implement the urban development and governance policy in time in the process of environmental pollution control, the excessive reliance on the professional knowledge and subjective judgment of experts, the inability to objectively evaluate the state of the natural environment, and the difficulty in collecting samples in the natural environment, this paper proposed a natural environment protection model based on machine learning and combined with random forest regression algorithm. Through the comparative analysis of the experimental results, the innovative natural environment protection model had an average improvement of 10.0% in four aspects compared with the traditional natural environment protection model.

## **1. Introduction**

The natural environment is an important part of human society, and is also the basis for the

coordination, continuity and sustainable development of regional urban development and natural environment protection. In the process of urban development and construction, in order to improve the utilization of resources, the impact assessment on the natural environment and the performance assessment and analysis of the natural environment have been carried out in a planned way. The relationship between urban development and natural environment protection is understood through the implementation of the specific content and impact degree of the project planning and policy measures. The future development direction and other aspects are investigated, and the corresponding countermeasures and suggestions are put forward. For example, technology development activities and ecotourism are carried out to promote sustainable development and balance and coordination of the natural environment in the process of urbanization.

Some experts and scholars have studied the implementation of local urban development strategies and the state of natural environment, hoping to find the internal relationship between urban development and natural protection environment, and put forward valuable suggestions for the coordinated development direction between the two. By studying the evolution of climate change and species diversity in the local natural environment and combining the impact of local social and natural cooperation programs on it, Seddon Nathalie produced new insights on the internal relationship between urban development and the state of the natural environment [1]. Whitburn Julie explored urban design and construction activities that destroy the natural environment. Combined with various assessment tools and methods, the research framework for the impact of urban activities on the natural environment was proposed, which enriched the research methods of local natural environment impact factors [2]. Hanson Jeffrey O explored the change trend of local natural environment. In combination with the degree of change of species living space in the local natural environment in the urban development protection policy, he reflected the effectiveness of the protection policy, which opened a new direction for the development of natural environment protection [3].

By studying the enrichment degree of local natural organic carbon and combining with the implementation of protective measures for mineral components, Hemingway Jordan D found that the protection of special mineral components in the process of urban development can effectively promote the conservation of organic carbon, which inspired new thinking for the local natural environment protection and development [4]. Bossio D A explored the effect of soil carbon on climate pollution in the natural environment. In combination with local climate change and changes in atmospheric carbon level, he clarified the efficient role of soil carbon in preventing and controlling atmospheric pollution and removing atmospheric carbon dioxide, and enriched local natural environmental protection measures [5]. Fahrig L summarized the environmental challenges faced in the the Belt and Road Initiative. He analyzed the development direction of environmental challenges and its significant impact on the economic field and urbanization process in detail, and proposed the development direction of natural environment protection, which strictly evaluated the state of the natural environment, and improved the local environmental protection standards [6].

By studying the ideology of local urban residents on natural environment protection and combining with the measures and implementation effects of local cities on natural environment protection, Molinario Erica reflected the level of awareness of local cities on natural environment protection. Based on the analysis of the results, the internal relationship between the level of consciousness of natural environment protection and the effect of natural environment protection was found, which enlightened the thinking of the significance of natural environment protection [7]. Shahzad Tahir explored the attitude of local residents towards natural environment protection. In combination with the proportion of the funds paid by local residents for the natural environment protection measures to their own income, he reflected the residents' attitude to the natural environment protection. Through the analysis of the results, it was found that the people at different

income stages had different attitudes to the natural environment protection [8]. Ponitka Jens explored the relationship between local natural environment and urban development. Combined with the impact of local measures to protect renewable resources on the state of the natural environment, it reflected the internal relationship between the natural environment and urban development [9]. The above research has expanded the development field of natural environment protection.

In addition, some experts and scholars explored and analyzed the evolution of the natural environment and the impact of the natural environment protection measures implemented in the process of urban development, hoping to improve the natural environment protection plan. By studying the effective combination between urban development and natural environment protection, and combining the promotion and development of tourism industry in local cities, Higgins-Desbiolles Freya organically combined local natural environment protection with urban development. The results showed that projects that combine natural environment with urban development can better promote the green development of urban construction [10]. Sadiq Muhammad explored the response measures to the local climate crisis. Combined with the development of new energy construction and the ability to cope with local climate pollution problems, the comprehensive analysis showed that the construction of new energy can play a key role in the prevention and control measures of climate pollution, and enrich the local prevention and control measures for air pollution problems [11]. Stelmasiak Jerzy explored the change trend under the influence of local pollution level of natural environment and local policy activities. Combining new tools and means to assess the state of local natural environment, he identified the key role of efficient assessment methods in the governance process, thus promoting the sustainable development of urban construction [12]. The above studies have not put forward a more complete plan for urban development and natural environment protection, and further research is needed.

In order to solve the problems in the traditional natural environment protection model, such as the failure to implement the urban development and governance policy in time, the excessive reliance on the professional knowledge and subjective judgment of experts, the inability to objectively evaluate the state of the natural environment, and the difficulty in collecting samples in the natural environment, this paper summarized the traditional natural environment protection plan, and displayed its advantages and disadvantages. Combined with machine learning technology, a new coordinated development plan of urban development and natural protection environment was proposed. This plan can timely implement the policies issued by the local government for the protection of natural environment and reduce the labor costs consumed in the implementation of the policies. It can also check the hidden dangers of the monitored natural environment, and it would also have a strong response ability to sudden natural environmental pollution problems.

## 2. Machine Learning Technology

With the rapid development of artificial intelligence (AI), machine learning has developed and expanded at an unprecedented speed as one of the key technologies [13]. AI is an important driving force for the scientific and technological revolution and the new round of industrial transformation. Accelerating the development of the next generation of AI is a strategic issue to seize the opportunities of the new round of scientific and technological revolution and industrial transformation. In recent years, the impact of AI technology on human society has become more profound and far-reaching, which provides new opportunities for the development of many fields. The improvement of machine learning technology can implement the development strategy of AI, and has important practical significance for promoting the urbanization process and protecting the natural environment. Machine learning is an important part of the growing field of data science. By

using statistical methods, algorithms are used to classify or predict to reveal the key insights of data mining projects. These insights can guide application and business decisions and effectively affect key growth indicators.

Machine learning is a comprehensive application based on computer technology, which mainly includes attribute recognition and process control, of which AI technology is the most widely used [14]. In this paper, the artificial neural network composed of intelligent computation and decision support system based on natural behavior modeling is composed of several different types of neurons at each time node of the experiment to process the amount of natural environment information collected. When the same information or task is divided by clustering, new connection points are formed, and the sample training is carried out iteratively in this process and the corresponding results are output. The model can also predict the data of the monitored sample, so as to get the change trend of the sample. The process of building the natural environment protection model proposed in this paper is a learning process that is repeated from simple to complex. The process of machine learning structure is shown in Figure 1.

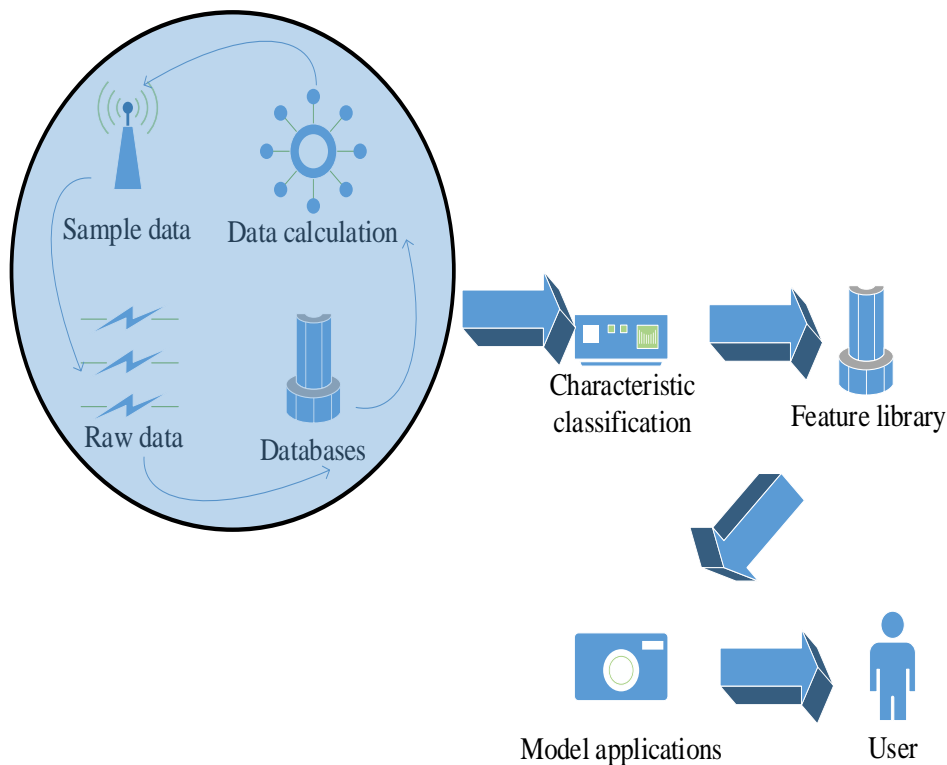


Figure 1. Machine learning architecture process

### 3. Development of Natural Environment Protection Plan in Urban Construction

Urbanization is an important socio-economic phenomenon in the process of industrialization, and also an important indicator to measure socio-economic development and productivity level. With the acceleration of urbanization and the growth of population, the environment on which human beings depend for survival and development has been constantly changing. The socio-economic problems related to resources, environment and population have become increasingly prominent. Environmental problems have become the main factor impeding the sustainable development of social economy. Therefore, in the process of urbanization development and construction, in dealing with the relationship between economic development and

environmental protection, it has become an important topic for the sustainable development of economy and society to attach great importance to natural protection and environmental protection.

With the development of urbanization, the mismatch between natural resources and ecological environment, and the continuous increase of urban construction activities, the impact on the ecosystem of natural environment is becoming more and more serious. The natural environment contains valuable ecological resources, which play an important role in maintaining ecological balance. In order to achieve a win-win situation between urban development and natural protection, attention should be paid to the formulation of natural environment protection plans. It is necessary to improve the awareness of local residents to protect the natural environment from urban construction and ecological protection, so as to restore a good ecological environment.

Nature conservation is the creation of a natural environment with biological diversity in the ecosystem to meet human survival, development and cultural needs, which would greatly promote social economy. Natural protection includes not only the use of natural environment and ecological resources in the process of urban construction, but also the understanding of the interdependent relationship between human and natural ecology. It covers urban development, resource utilization, economic growth and other aspects, and comprehensively renovates and transforms the natural environment and ecological environment within a certain range. The structure flow of traditional natural and environmental protection is shown in Figure 2.

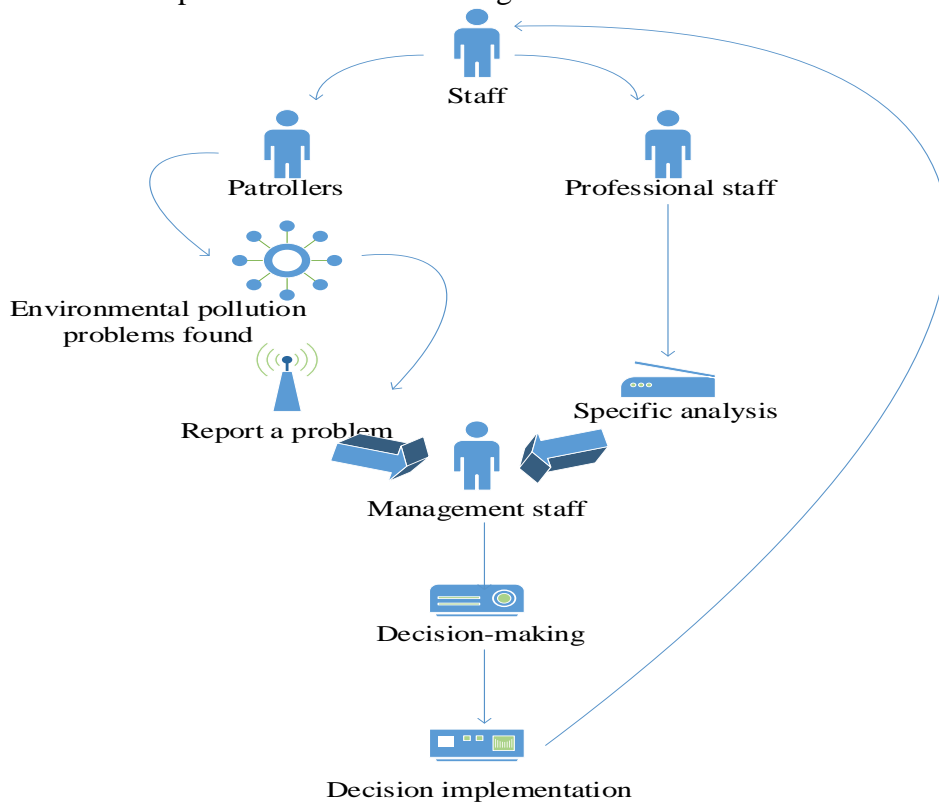


Figure 2. Traditional nature and environmental protection structural processes

#### 4. Random Forest Regression Algorithm

The model constructed in this paper uses the random forest regression algorithm [15], and takes the decision tree as the basic learner. Through clustering analysis of several collected environmental analog quantities, and then conducting a large number of sample training, the training model is used to predict the state of the natural environment, so as to achieve real-time monitoring and prediction

of the sample environment. First, the analog quantities collected from the sample environment are injected into the sample data set  $W$  to generate group  $S$  data clusters.  $W$  meets Formula (1):

$$W = \{(a_n, b_n), n = 1, 2, \dots, i\} \tag{1}$$

Among them,  $a_n$  and  $b_n$  are the samples in the random attribute variables, and the original sample set  $W$  is sampled and trained several times to generate the training set. Group  $S$  data clusters are divided into extracted and un-pulled data. Each group of data clusters would generate  $S$  decision trees through the training process. Each decision tree is trained by the sample set independently selected from the random attribute variables  $A$  and  $B$ , and the mean square generalization error of the random attribute prediction value  $h(A)$  is calculated by Formula (2):

$$E_{A,B} (B - h(A))^2 \tag{2}$$

For each sub-sample set, their respective regression models are established, and their respective decision trees are generated to obtain the predicted values of relevant random attribute variables, as shown in Formula (3):

$$\{h(\iota, A_n), n = 1, 2, \dots, S\} \tag{3}$$

Among them,  $\iota$  is the random vector related to the decision tree. The prediction result of this model is obtained by taking the arithmetic mean of  $S$  regression tree. Finally, through continuous injection of data sets to reduce the mean square generalization error calculated by the model and accurately obtain the predicted environmental data, the predicted sample state can be obtained through comparative analysis, thus realizing the prediction of the evolution trend of the sample state. The above are some algorithms used to build the natural environment protection model in this paper. The structure flow of the algorithm is shown in Figure 3.

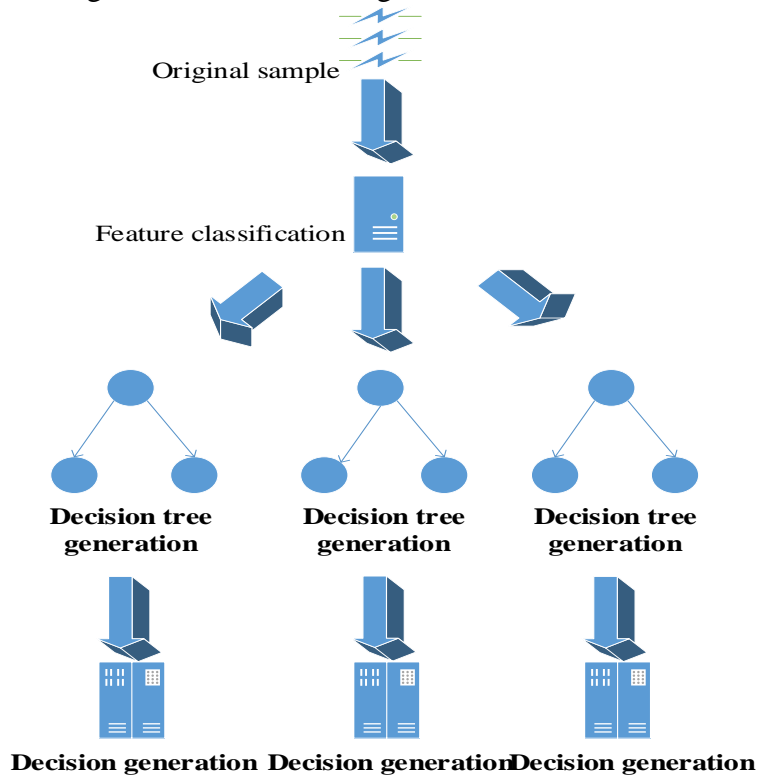


Figure 3. Random forest regression algorithm structure flow

## 5. Natural Environment Protection Model Experiment Based on Machine Learning

The machine learning technology was used to monitor and predict the quality of the natural environment. The natural environment simulation parameters collected in each section of the sample area were included in the collection range, and the collected natural environment simulation parameters were sorted into original data sets and injected into the natural environment protection model built in this paper. After that, the original data was classified and calculated by random forest regression algorithm to form a decision tree, and then the mean square generalization error value of the decision was reduced by continuous injection of training samples. The final decision was compared and analyzed to get the optimal decision, which was used to monitor and predict the quality of the natural environment in real time. In the process of efficient implementation of urban development, the policies and measures formulated can also respond to sudden natural environmental pollution problems in time, so as to promote the coordinated development between urban development and natural protection environment. In order to study the application effect of the natural environment protection model, it is very important to establish the evaluation standard of the model effect. Table 1 shows the classification of some evaluation criteria and rules of conduct.

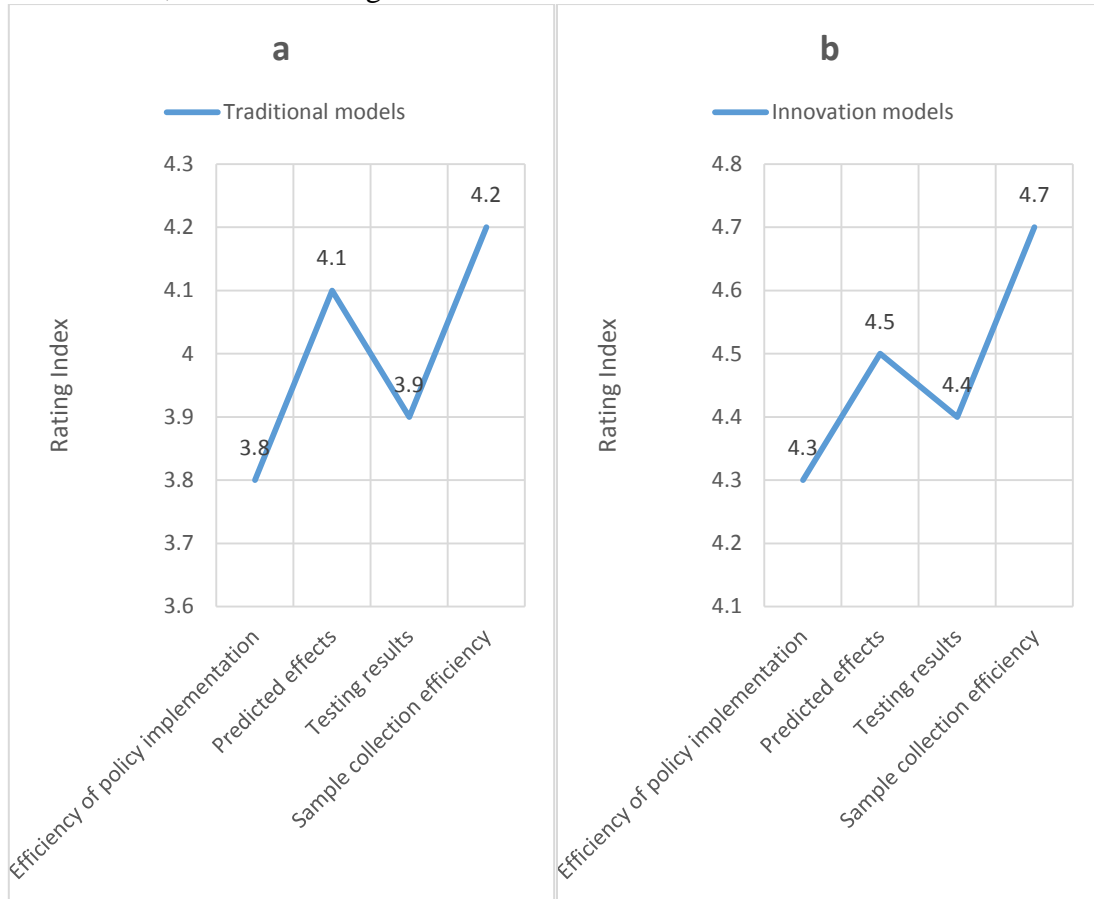
*Table 1. Evaluation criteria and their evaluation rules*

Evaluation indicators	Rules of Conduct
Efficiency of policy implementation	Speed of policy implementation Policy implementation time
Predicted effects	Predicted state occurrence probability Predicted speed

The traditional natural environment protection model is optimized, so that the urbanization process is gradually promoted, and the urban development and natural protection environment are coordinated. First, by dividing the natural environment in local cities into regions, the overall sample is divided into classified sample intervals with the same characteristics, and the natural environment simulation quantity is collected from each sample interval. The collected analog quantities, such as atmospheric carbon content, water copper content, soil temperature and humidity, are used for fuzzy conversion, and then injected into the natural environment protection model to form the original data set. After that, the original data are classified and calculated by random forest regression algorithm. The data sets with the same characteristics are divided into several data clusters, and the mean square generalization error is calculated to form a decision tree. The training samples are continuously injected into the model to reduce the mean square generalization error and promote the generation of the training model. The final decision is compared and analyzed to obtain the optimal decision, and then the training model is used to predict the environmental state level of each sample interval.

Firstly, the natural environment in the local city was divided into regions, and then the AI technology was used to collect the environmental simulation parameters in each sample interval. The collected environmental parameters were fuzzy processed, and then the random forest regression algorithm was used to classify the features and calculate the mean square generalization error, thus forming multiple decision trees. After continuous injection of sample data and

continuous reduction of mean square generalization error, the final decision trees were compared and analyzed to obtain the optimal decision. The training model obtained in this process was used to monitor and predict the real-time environmental status of each sample interval. It can not only implement the decisions made, but also identify possible environmental pollution problems. After a period of experiment, a questionnaire survey was conducted to local urban residents and system participants according to the experimental results, and the feedback data was used for evaluation. The performance of the proposed natural environment protection model based on machine learning and the traditional natural environment protection model were compared and analyzed according to the evaluation rules, as shown in Figure 4.



a. Performance analysis of traditional models

b. Performance analysis of innovative models

Figure 4. Comparative analysis of the performance of traditional and innovative models of natural environment protection

Figure 4a shows the performance analysis of the traditional natural environment protection model. The performance indexes of the four performance indicators of policy implementation efficiency, prediction efficiency, detection efficiency and sample collection efficiency were 3.8, 4.1, 3.9 and 4.5 respectively. Figure 4b shows the performance analysis of the innovative natural environment protection model. The performance indexes of the four performance indicators of policy implementation efficiency, prediction efficiency, detection efficiency and sample collection efficiency were 4.3, 4.5, 4.4 and 4.7 respectively. From the comparative analysis of the four performance indicators data, it can be seen that the innovative natural environment protection model



was better than the traditional natural environment protection model. Through the comparison of the two, the innovative urban and rural natural environment protection model proposed in this paper had an average increase of 10.0% in four aspects of performance compared with the traditional urban and rural natural environment protection model.

## 6. Conclusion

Urban development and natural protection promote each other and progress together. The protection of natural environment is a complex system engineering, involving human survival environment and social development. Theoretically, with the economic growth and the acceleration of urbanization process and other factors, the development and utilization rate of resources would increase, but its negative effects can not be ignored. This paper proposed a natural environment protection model based on machine learning and combined with stochastic forest regression algorithm. Finally, the reliability of the model was verified by experiments. Compared with the traditional natural environment protection model, it would have a stronger ability to deal with sudden environmental pollution problems.

## Funding

This article is not supported by any foundation.

## Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

## Conflict of Interest

The author states that this article has no conflict of interest.

## References

- [1] Seddon, Nathalie. "Getting the message right on nature -based solutions to climate change." *Global change biology* 27.8 (2021): 1518-1546.
- [2] Whitburn, Julie, Wayne Linklater, and Wokje Abrahamse. "Meta - analysis of human connection to nature and proenvironmental behavior." *Conservation biology* 34.1 (2020): 180-193.
- [3] Hanson, Jeffrey O. "Global conservation of species' niches." *Nature* 580.7802 (2020): 232-234.
- [4] Hemingway, Jordon D. "Mineral protection regulates long-term global preservation of natural organic carbon." *Nature* 570.7760 (2019): 228-231.
- [5] Bossio, D. A. "The role of soil carbon in natural climate solutions." *Nature Sustainability* 3.5 (2020): 391-398.
- [6] Fahrig L. "Environmental challenges for the Belt and Road Initiative." *Nature Sustainability* 1.5 (2018): 206-209.
- [7] Molinario, Erica. "Motivations to act for the protection of nature biodiversity and the environment: a matter of "Significance". " *Environment and Behavior* 52.10 (2020): 1133-1163.
- [8] Shahzad, Tahir. "People's attitude towards willingness-to-pay for environmental protection in Pakistan." *Environmental Science and Pollution Research* 29.35 (2021): 52635-52654.
- [9] Ponitka, Jens, and Sarah Boettner. "Challenges of future energy landscapes in Germany—a nature conservation perspective." *Energy, Sustainability and Society* 10.1 (2020): 1-11.

- [10] Higgins-Desbiolles, Freya. "Socialising tourism for social and ecological justice after COVID-19." *Tourism Geographies* 22.3 (2020): 610-623.
- [11] Sadiq, Muhammad. "Linking nuclear energy, human development and carbon emission in BRICS region: Do external debt and financial globalization protect the environment?." *Nuclear Engineering and Technology* 54.9 (2021): 3299-3309.
- [12] Stelmasiak, Jerzy. "Nature Reserve as a Legal Form of Nature Protection." *Studia Iuridica Lublinensia* 29.2 (2020): 163-172.
- [13] Janiesch, Christian, Patrick Zschech, and Kai Heinrich. "Machine learning and deep learning." *Electronic Markets* 31.3 (2021): 685-695.
- [14] Jiang, Tammy, Jaimie L. Gradus, and Anthony J. Rosellini. "Supervised machine learning: a brief primer." *Behavior Therapy* 51.5 (2020): 675-687.
- [15] Zhang, Wengang, et al. "Assessment of pile drivability using random forest regression and multivariate adaptive regression splines." *Georisk: Assessment and Management of Risk for Engineered Systems and Geohazards* 15.1 (2021): 27-40.